CLAIMS

1. The molecules selected, from those which could be made in a combinatorial synthesis of specified reactants and common core, by the following computer-based method:

a. generating a virtual library by:

(1). creating one or more files identifying one or more combinatorial reactions for one or more core structures;

(2). creating separate structural variation files (associated with the reaction identifying files) in which are listed together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction;

(3). associating with each structural variation, data, characterizing each structural variation including:

(a). characterization data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has not been derived from the application of validated molecular structural descriptors; and

(b). characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has been derived from applying validated molecular structural descriptors to the structural variations;

b. identifying in the virtual library all possible combinatorial product molecules which could result from the specified reactants and core molecule;

c. selecting from all possible combinatorial product molecules a product molecule for inclusion in the subset;

d. using a validated molecular descriptor appropriate to whole molecules with which the Virtual Library was generated, removing from the set of all remaining molecules those molecules falling within a chosen neighborhood distance of the selected molecule;

e. using a validated molecular descriptor appropriate to the structural variations with which the Virtual Library was generated, removing from the set of all remaining product molecules those molecules formed from structural variations falling within a chosen neighborhood distance of the structural variations of the selected molecule;

f. selecting from the set of all product molecules remaining after step **e** a product molecule for inclusion in the subset;

g. repeating steps **d** through **f** until no additional product molecules remain to be selected

in step **f**; and

h. Outputting a list of the selected subset and/or the reactants from which the subset can be formed.

2. The molecules selected, from those which could be made in a combinatorial synthesis of specified reactants and cores, by the following computer-based method:

a. generating a virtual library by:

(1). creating one or more files identifying one or more combinatorial reactions for one or more core structures;

(2). creating separate structural variation files (associated with the reaction identifying files) in which are listed together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction;

(3). associating with each structural variation, data, characterizing each structural variation including:

(a). characterization data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has not been derived from the application of validated molecular structural descriptors; and

(b). characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has been derived from applying validated molecular structural descriptors to the structural variations;

b. selecting from all possible cores a core upon which to base the subset;

c. using a validated molecular descriptor appropriate to cores, selecting from the set of all possible cores those core molecules falling within the neighborhood distance of the selected core molecule;

d. identifying all possible combinatorial product molecules which could result from the specified reactants and selected core molecules;

e. selecting from all possible combinatorial product molecules a product molecule for inclusion in the subset;

f. using a validated molecular descriptor appropriate to whole molecules with which the Virtual Library was generated, removing from the set of all remaining molecules those molecules falling within a chosen neighborhood distance of the selected molecule;

g. using a validated molecular descriptor appropriate to the structural variations with which

the Virtual Library was generated, removing from the set of all remaining product molecules those molecules formed from structural variations falling within a chosen neighborhood distance of the structural variations of the selected molecule;

h. selecting from the set of all product molecules remaining after step **g** a product molecule for inclusion in the subset;

i. repeating steps **f** through **h** until no additional product molecules remain to be selected in step **h**; and

j. Outputting a list of the selected subset and/or the reactants from which the subset can be formed.

3. The molecules selected, from those which could be made in a combinatorial synthesis of specified reactants and common core, by the following computer-based method:

a. generating a virtual library by:

(1). creating one or more files identifying one or more combinatorial reactions for one or more core structures;

(2). creating separate structural variation files (associated with the reaction identifying files) in which are listed together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction;

(3). associating with each structural variation, data, characterizing each structural variation including:

(a). characterization data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has not been derived from the application of validated molecular structural descriptors; and

(b). characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has been derived from applying validated molecular structural descriptors to the structural variations;

b. identifying in the virtual library all possible combinatorial product molecules which could result from the specified reactants and core molecule;

c. selecting from all possible combinatorial product molecules a product molecule for inclusion in the subset;

d. using a combination validated molecular descriptor characterizing both whole molecule and structural variation features with which the Virtual Library was generated, removing

from the set of all remaining molecules those molecules falling within a chosen neighborhood distance of the selected molecule;

e. selecting from the set of all product molecules remaining after step **d** a product molecule for inclusion in the subset;

f. repeating steps **d** through **e** until no additional product molecules remain to be selected in step **e**; and

h. Outputting a list of the selected subset and/or the reactants from which the subset can be formed.

4. The molecules selected, from those which could be made in a combinatorial synthesis of specified reactants and cores, by the following computer-based method:

a. generating a virtual library by:

(1). creating one or more files identifying one or more combinatorial reactions for one or more core structures;

(2). creating separate structural variation files (associated with the reaction identifying files) in which are listed together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction;

(3). associating with each structural variation, data, characterizing each structural variation including:

(a). characterization data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has not been derived from the application of validated molecular structural descriptors; and

(b). characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has been derived from applying validated molecular structural descriptors to the structural variations;

b. selecting from all possible cores a core upon which to base the subset;

c. using a validated molecular descriptor appropriate to cores, selecting from the set of all possible cores those core molecules falling within the neighborhood distance of the selected core molecule;

d. identifying all possible combinatorial product molecules which could result from the specified reactants and selected core molecules;

e. selecting from all possible combinatorial product molecules a product molecule for

inclusion in the subset;

f. using a combination validated molecular descriptor characterizing both whole molecule and structural variation features with which the Virtual Library was generated, removing from the set of all remaining molecules those molecules falling within a chosen neighborhood distance of the selected molecule;

g. selecting from the set of all product molecules remaining after step **f** a product molecule for inclusion in the subset;

f. repeating steps **f** through **g** until no additional product molecules remain to be selected in step **g**; and

h. Outputting a list of the selected subset and/or the reactants and cores from which the subset can be formed.

5. The molecules, which are most likely to have the same type of activity as a molecule of interest, selected, from those which could be made in a combinatorial synthesis from specified reactants and a common core molecule, by the following computer-based method:

a. generating a virtual library by:

(1). creating one or more files identifying one or more combinatorial reactions for one or more core structures;

(2). creating separate structural variation files (associated with the reaction identifying files) in which are listed together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction;

(3). associating with each structural variation, data, characterizing each structural variation including:

(a). characterization data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has not been derived from the application of validated molecular structural descriptors; and

(b). characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has been derived from applying validated molecular structural descriptors to the structural variations;

b. identifying in the virtual library all possible combinatorial product molecules which could result from the specified reactants and selected core molecules;

c. characterizing the molecule of interest with both a validated molecular structural

descriptor appropriate to structural variations with which the virtual library was generated and with a validated molecular structural descriptor appropriate to structural variations with which the virtual library was generated;

d. using the same validated molecular descriptor appropriate to whole molecules, selecting the set of all possible molecules whose descriptor values fall within a chosen neighborhood distance of the selected molecule, and using the same validated molecular descriptor appropriate to structural variations, selecting the set of all possible molecules whose descriptor values fall within a chosen neighborhood distance of the selected molecule; and

e. Ouputting a list of the selected subset and/or the reactants from which the subset can be formed.

6. The molecules, which are most likely to have the same type of activity as a molecule of interest, selected, from those which could be made in a combinatorial synthesis from specified reactants and a common core molecule, by the following computer-based method:

a. generating a virtual library by:

(1). creating one or more files identifying one or more combinatorial reactions for one or more core structures;

(2). creating separate structural variation files (associated with the reaction identifying files) in which are listed together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction;

(3). associating with each structural variation, data, characterizing each structural variation including:

(a). characterization data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has not been derived from the application of validated molecular structural descriptors; and

(b). characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has been derived from applying validated molecular structural descriptors to the structural variations;

b. identifying in the virtual library all possible combinatorial product molecules which could result from the specified reactants and selected core molecules;

c. characterizing the molecule of interest with a combination validated molecular

descriptor, characterizing both whole molecule and structural variation features, with which the Virtual Library was generated;

d. using the same validated molecular descriptor, selecting the set of all possible molecules whose descriptor values fall within a chosen neighborhood distance of the selected molecule; and

e. Ouputting a list of the selected subset and/or the reactant from which the subset of molecules can be formed.

7. The molecules, which are most likely to have the same type of activity as a molecule of interest which is not known to be derived from a combinatorial reaction, selected from those product molecules which could be created by all combinatorial arrangements of structural variations and core molecules, by the following computer-based method:

a. generating a virtual library by:

(1). creating one or more files identifying one or more combinatorial reactions for one or more core structures;

(2). creating separate structural variation files (associated with the reaction identifying files) in which are listed together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction;

(3). associating with each structural variation, data, characterizing each structural variation including:

(a). characterization data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has not been derived from the application of validated molecular structural descriptors; and

(b). characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has been derived from applying validated molecular structural descriptors to the structural variations;

b. fragmenting the molecule of interest as described in a fragmentation table;

c. selecting a fragmentation pattern;

d. aligning the fragments according to topomeric alignment rules;

e. generating CoMFA fields for each aligned fragment;

f. identifying which reaction types within the virtual library correspond to the reaction type resulting from the fragmentation;

g. identifying whether the fragmentation pattern generated a core, and, if so, implementing the following steps:

(1) characterizing the core with CoMFA fields; and

(2) identifying, by comparing the field values, whether the core resembles any cores used in the creation of the virtual library;

h. selecting structural variations which were used in generating the virtual library with cores which matched the core resulting from the fragmentation;

i. comparing the CoMFA fields of the topomerically aligned fragments with the fields of the identified structural variations by taking the root sum of squares field differences;

j. selecting those structural variations for which the root sum of squares field difference falls within a chosen neighborhood value;

k. ouputting a list of the selected subset and/or the structural variations from which the subset can be forme;

l. repeating steps **c** through **k** for all possible fragments.